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Formation MicroScanner (FMS) data and orbital cycle records: preliminary interpretation from the Asian Monsoon IODP Expedition 346

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Recently, IODP Expedition 346 (29 July–27 September 2013) drilled seven sites in in the marginal sea bordered by the Eurasian continent, the Korean Peninsula, and the Japanese Islands, as well as two closely spaced sites in the East China Sea. Expedition 346 was the first scientific drilling expedition ever to focus exclusively on the climate system in this region.

During the expedition, the Formation MicroScanner (FMS) downhole logging tool was deployed, providing high-resolution electrical resistivity–based images of borehole walls. Features such as bedding, slump folding and bioturbation can be resolved. Here we analyze FMS image resistivity data collected at Site U1425 that extend back to the Miocene. Analysis allowed the recognition of several FMS intervals, with vertical extension ranging from several tens of centimeters to a few meters, with an apparent cyclicity. These FMS intervals correlate well with other downhole logs (Total Gamma Ray, Uranium, Thorium, Potassium and density).

Conductive intervals generally correlate with low gamma ray and low density log values. Conversely, more resistive intervals generally correlate with higher values in the gamma ray and bulk density logs. This relationship can be interpreted in terms of the relative abundance of terrigenous clay/diatoms in the sediment. Clay has high K and Th contents and relatively higher density and lower porosity than higher diatom-rich sediment. Consequently, with the exception of sporadic ash and dolomite layers, conductive intervals in the FMS images tend to reflect intervals enriched in diatoms, whereas resistive intervals reflect relative high-terrigenous clay content. An apparent cyclic nature, with several orders of cycles on the FMS images, is locally clearly observed. The cyclic pattern consists of ∼4–8 m thick resistive intervals alternating with conductive intervals, generally correlating in core with laminated (diatomite or carbonate rich) intervals. These conductive intervals often contain higher frequency, smaller scale interbedded layers. The transition between resistive and conductive intervals is marked by an intermediate level of medium conductivity in the FMS images, possibly indicating relative changes in productivity conditions.

The FMS images have been interpreted in term of FMS facies (low, medium, high conductivity) and their thickness measured along a 100-m long interval since the late Miocene. Vertical changes in thickness of FMS facies are plotted vs. depth, and we propose an attempt of orbital tuning based on the Site U1425 preliminary age model. In the future, the FMS data will be compared to other proxies measured on cores, and physical and chemical properties of sediments such as color reflectance or XRF data.

This research project is undertaken as part of IODP Expedition 346.

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